

# *National Air and Space Intelligence Center*

## **So You Think You Have It Tough?**



**Mr. Wm H. Deleranko**  
**Senior Intelligence Analyst**  
**Technology & Modernization Division**

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# *Purpose*

**To provide an overview  
of NASIC's technology  
warning responsibility,  
and how tough it can be  
to assess foreign  
technology maturity**

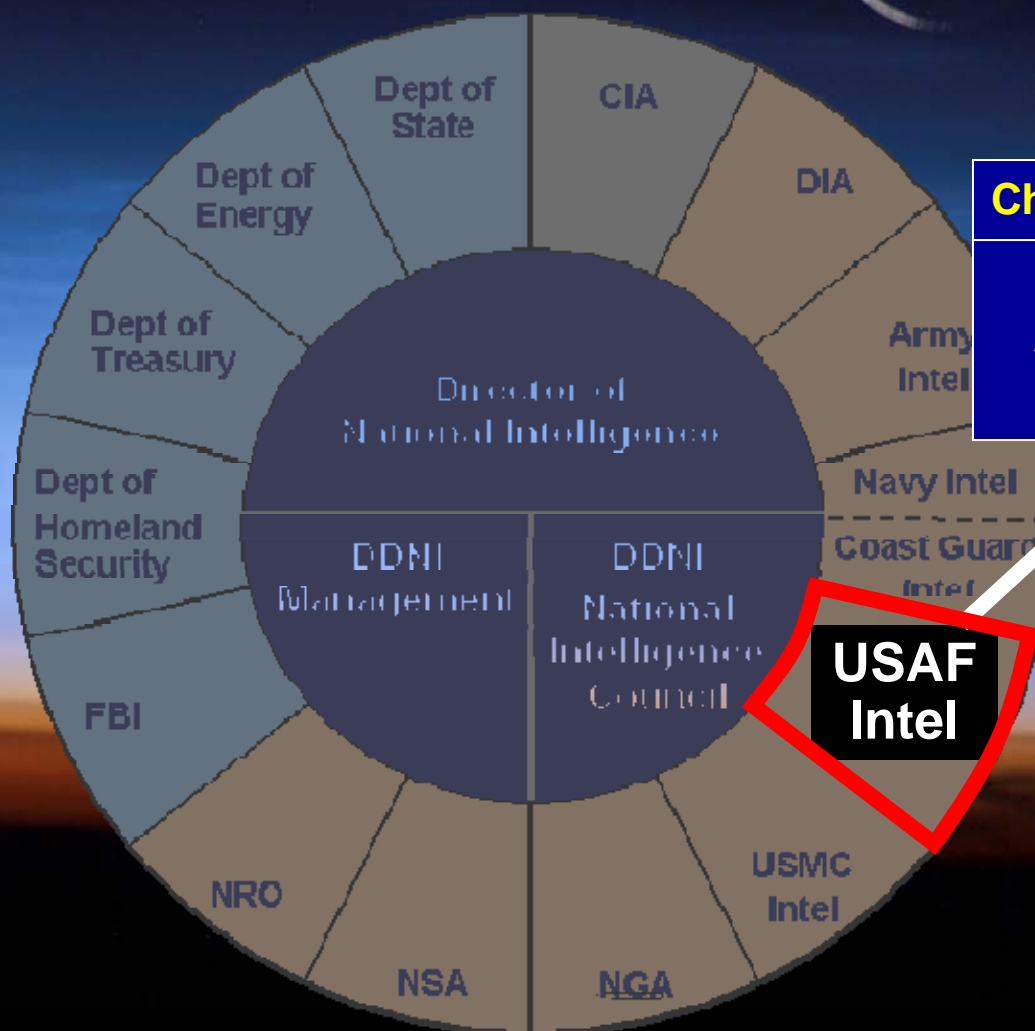


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# Who is NASIC ?



**Chain of Command**

**USAF/A2  
AF ISR Agency  
NASIC**

**USAF  
Intel**

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## NASIC Mission

**Produce Integrated, Predictive  
Air & Space Intelligence**



**... to Secure Our Nation's Future**

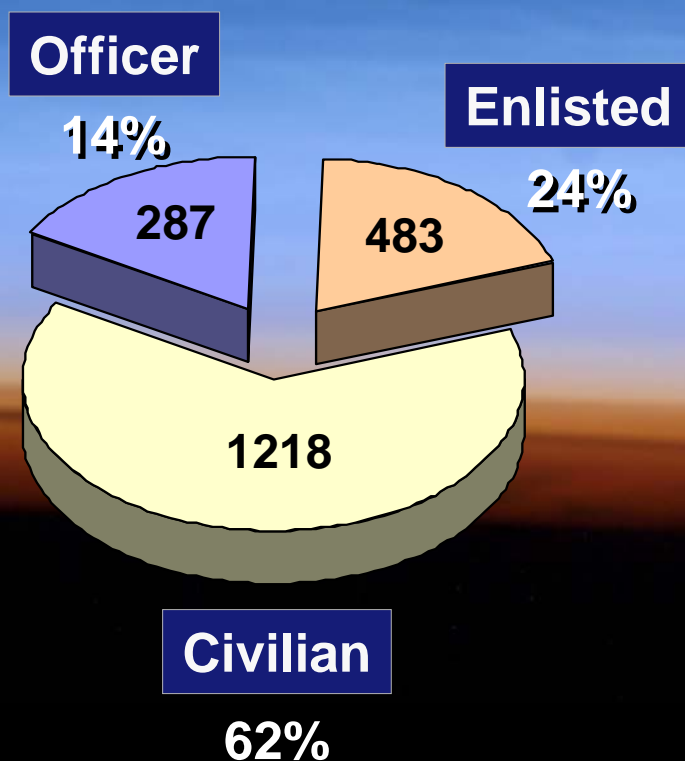
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# Programmed FY07 Resources

## Manpower 1988 Billets



### Total Force on Site

~ 2600

Contractors

NGA

DIA

JRIC



# ***Technology Division Mission***



**Mission: Conduct all-source analysis of emerging foreign aerospace research, development and acquisition (RD&A) programs. Provides strategic warning of disruptive technologies, technology transfer, air modernization developments and proliferation of aerospace systems.**



**Breakthroughs in technology  
with a 20 year outlook**



**Foreign Technology Transfer  
and acquisition networks**



**Air RDA with emphasis on  
R&D processes, programs  
and resources**

**Focus: conception to acquisition of new technologies/force capabilities**



# ***Technologies Tracked***

## **(TRLs 1-9)**

**Advanced Computing**

**Advanced Electronics**

**Information Technology**

**Technology Integration**

**Biotechnologies**

**Anti-Materials**

**Advanced Sensors**

**Signature Modification**

**Power Technology**

**Weather Modification**

**Directed Energy**

**Nanotechnologies**

**Energetic Materials**

**Hypersonics**

**Materials Science**



***Denotes STIC  
Subcommittee Chair***

**Focus on air and space applications of disruptive technologies**





# ***Air/Space Superiority***

## **Examples of Warning Concern**

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**AAM system  
development and  
proliferation**



**Biosensor enabled  
UAV swarms**



**Influence of COTS  
(e.g. radar DSPs)**



**RDA timelines for  
foreign UCAV  
developments**

**The ability to control what moves through air and  
space...ensures freedom of action**



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# *Rapid Global Mobility*

## Examples of Warning Concern



**Radio Controlled  
Micro Air Vehicles**



**Biotechnology -  
Anti-material agents**



**ISR UAV  
proliferation**



**EW radar  
developments**

**The ability to rapidly position forces anywhere in the world...ensures unprecedented responsiveness.**



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# ***Global Attack***

## **Examples of Warning Concern**



**Tri-sonic/hypersonic  
aerodynamic test facilities**



**Counterspace system  
developments**



**Ballistic missile system  
proliferation**



**Satellite launch facility  
modifications**

**The ability to engage targets anywhere,  
anytime...holds any adversary at risk.**

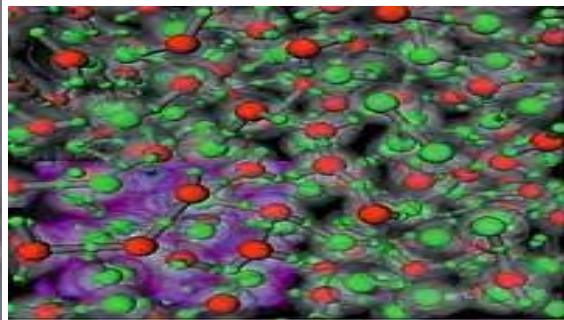


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# *Information Superiority*

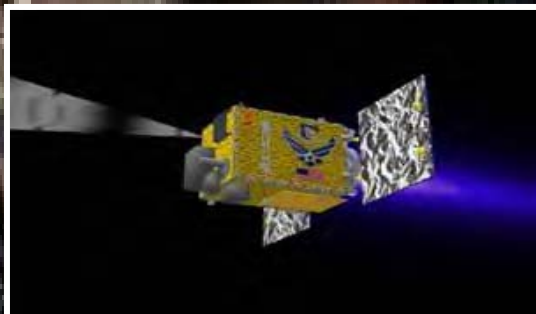
## Examples of Warning Concern



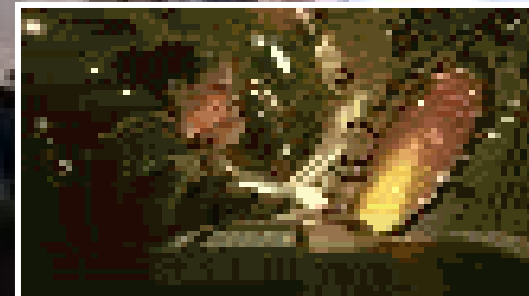
**Quantum computing  
technology**



**Computer  
Network Attack**



**Microsatellite  
capability**



**C4 system  
developments**

**The ability to control and exploit information to our  
nation's advantage...ensures decision dominance.**

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# Precision Engagement

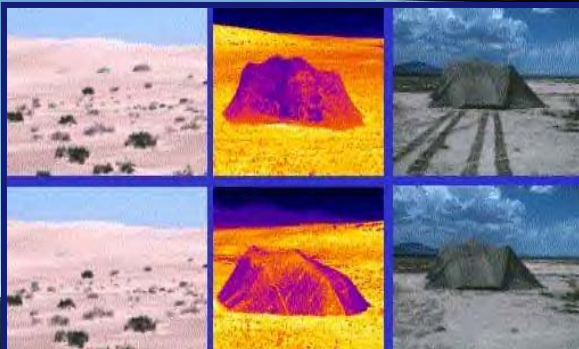
## Examples of Warning Concern



**Directed Energy - RF  
Weapons Technology**



**Integrated Air Defense  
Modifications**



**Denial & Deception  
Test Activity**



**GPS Jammer  
Proliferation**

**The ability to deliver desired effects with minimal risk and collateral damage...denies the enemy sanctuary**

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# ***Agile Combat Support***

## **Examples of Warning Concern**

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**Lethal UAV  
Proliferation**



**Energetic Materials  
Technology**



**Weather  
Modification**



**LACM  
Developments**

**The ability to sustain flexible and efficient combat operations...is the foundation of success**



# *How Tough Is It?*

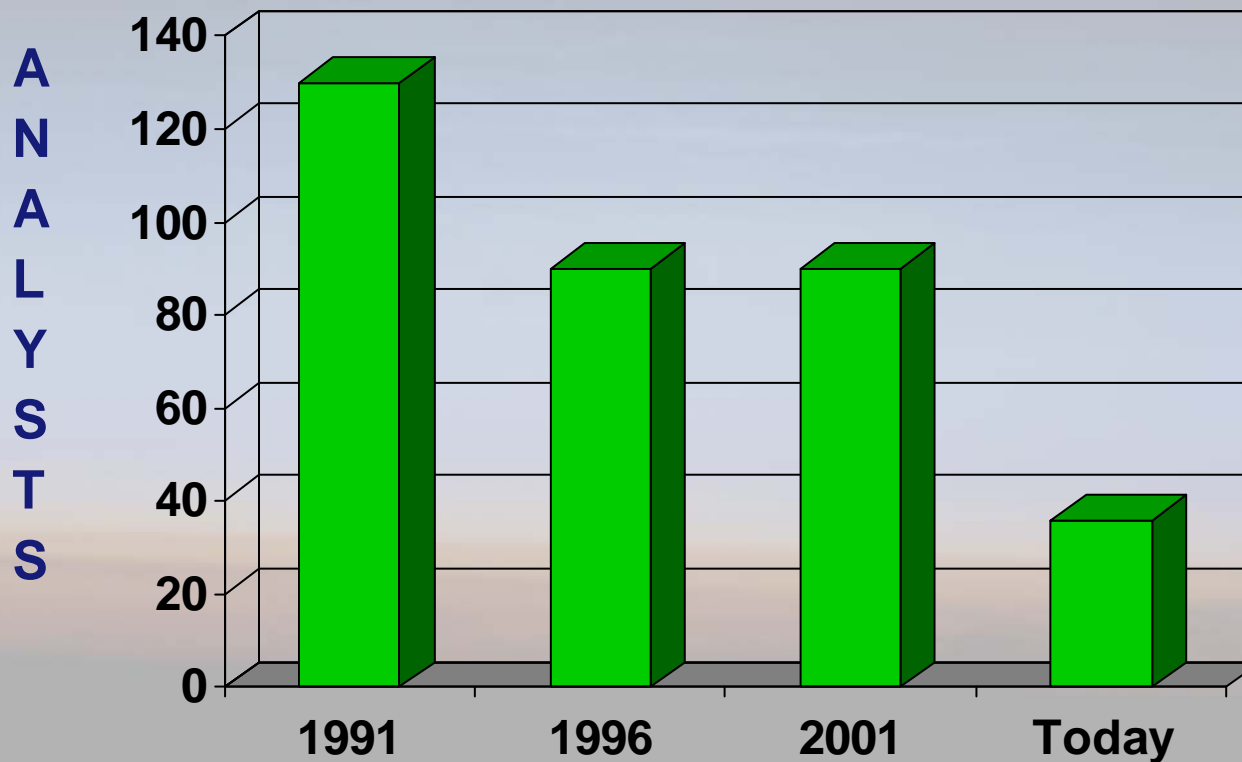


- **Must understand the technology**
  - Foreign countries may take alternative approaches
  - 70% of the world's R&D conducted outside the U.S.
- **Discover the R&D programs**
  - Main Players, Facilities, Funding, TRL
- **Identify intent**
  - Threat Application, Military Sponsorship
- **Predict IOC**
  - How many (types and numbers)
- **Assess how the threat will be employed**
  - Unit Subordination, Tactics and Doctrine
- **Determine the impact (i.e., how significant is the threat)**
- **Track technology proliferation (buyers, sellers, and copiers)**



# *How Tough Is It?*

## NASIC's Technology Division

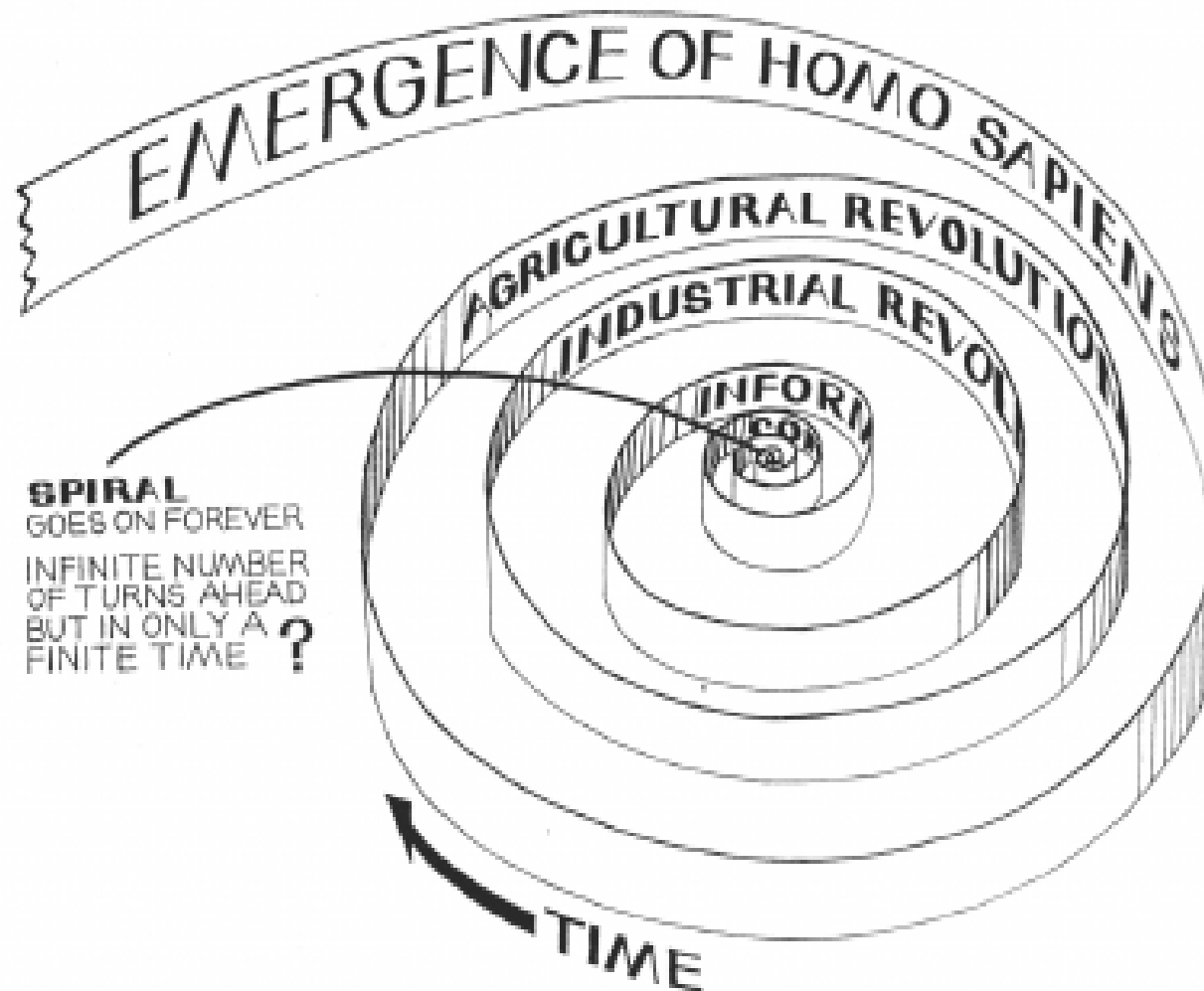


**Total within DoD Intel is ~ 100!  
NASIC is the largest!!**





## *How Tough Is It?*



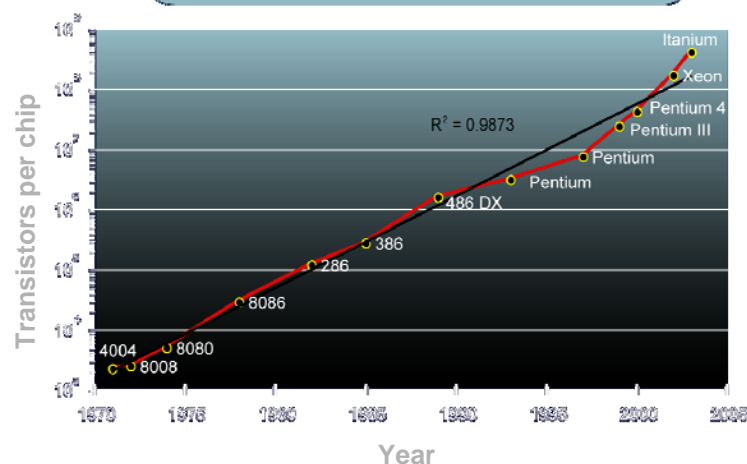
**We live in exponentially accelerating times!**



# How Tough Is It? Accelerating Trends



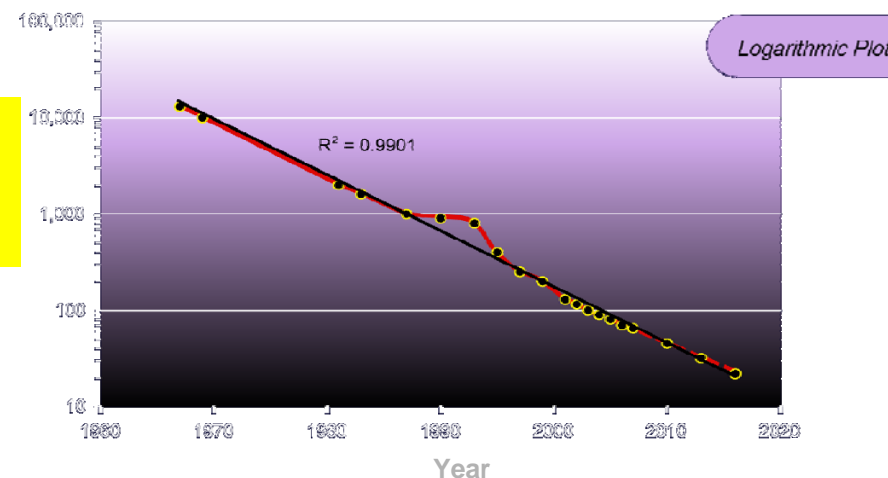
Transistors (Intel processors)



Logarithmic Plot

# per chip  
doubles  
every 2 yrs

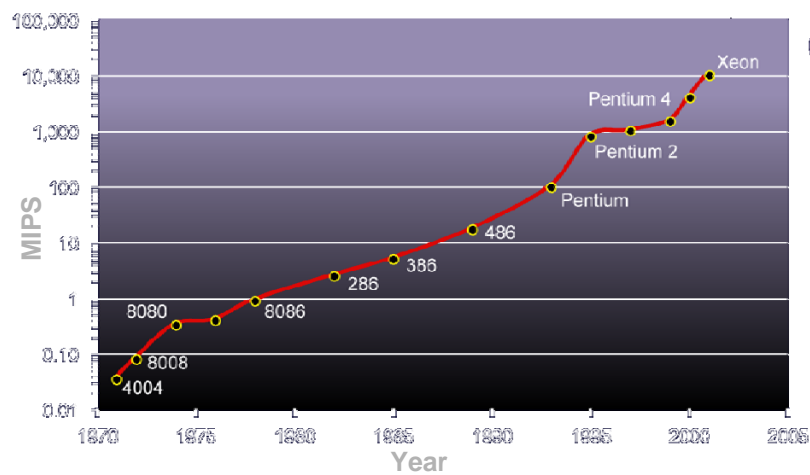
Dynamic RAM Memory "Half Pitch" Feature Size



Logarithmic Plot

Half size reduction every 5.4 yrs

Processor Performance (MIPS)



Logarithmic Plot

Doubles every 1.8 yrs

**Metcalf's Law** – Economic value of a network increases as the square of the number of connections

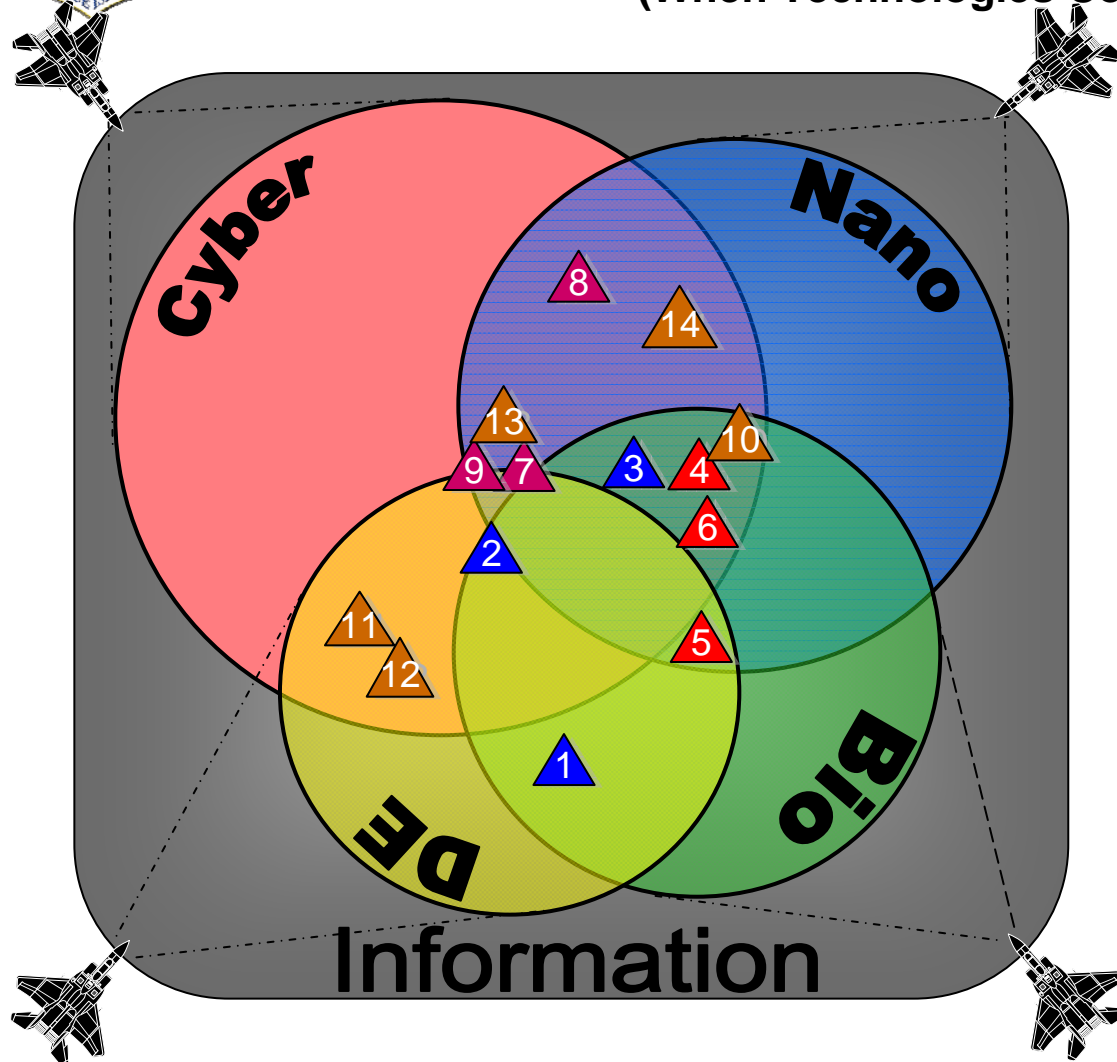
**Moore's Law** - Miniaturization Processing, storage, Price/Performance 2X every 12-18 months

**Gilder's Law** - Bandwidth increases 3X every 36 months



# How Tough Is It? Synergistic Effects

(When Technologies Collide)



- 1 Non-lethal HPM weapons
- 2 Ladar imaging systems
- 3 Covert Tag/Track/Target

- 4 Soldier suit
- 5 Nano-delivered medical
- 6 Fast vaccine development

- 7 Satellite augmentation
- 8 Intelligent nano AAA
- 9 Swarming ISR

- 10 Human augmentation
- 11 Air/space-based lasers
- 12 Air/Space relay mirrors
- 13 Quantum computing
- 14 Self-healing/smart skins



# How Tough Is It?

## The Globalization of S&T

**"In 2001, India graduated almost a million more students from college than the United States did. China graduates twice as many students with bachelor's degrees as the U.S., and they have six times as many graduates majoring in engineering. In the international competition to have the biggest and best supply of knowledge workers, America is falling behind."**

**--"The World is Flat", Friedman, 2005**

**China's Gross Domestic Product is now 2<sup>nd</sup> in the world to the U.S.**

**For the first time ever, all members of China's Politburo Standing Committee, the highest tier within the Communist Party, are card-carrying engineers.**

**China had 15 companies on Forbes Global 500 list in 2004, up by 4 from the 2003 rankings.**

**India had only 1 company on the Global 500 in 2003. In 2004, there are 4 Indian companies.**

**IBM Global Services India unveiled its global delivery centre in Hyderabad on June 14, 2005, the fifth IBM center in India.**

**" The last 25 years in technology have just been "the warm-up act." Now we are going into the main event, and by the main event, I mean an era in which technology will truly transform every aspect of business, of government, of society, of life."**

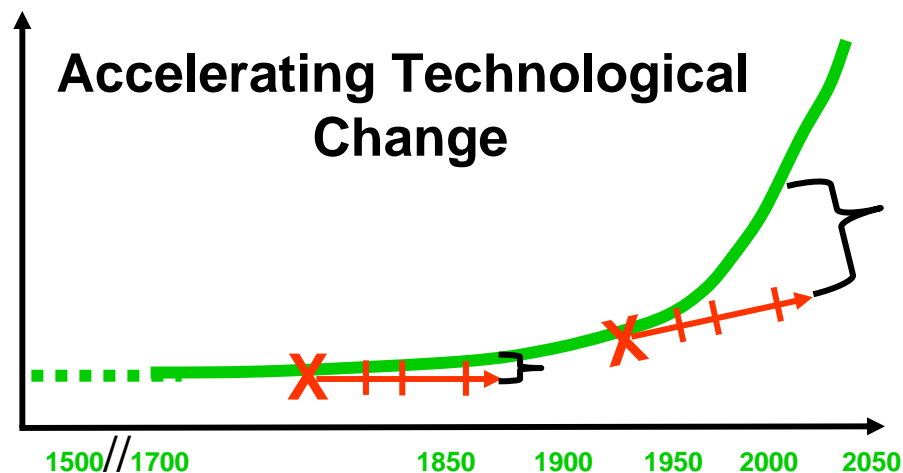
***Carly Fiorina, Hewlett-Packard CEO  
2004***



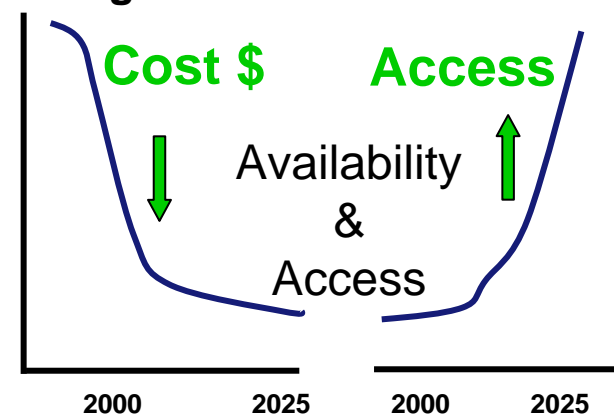


# How Tough Is It?

## The Curve and Curveball



What belonged to few now available to many

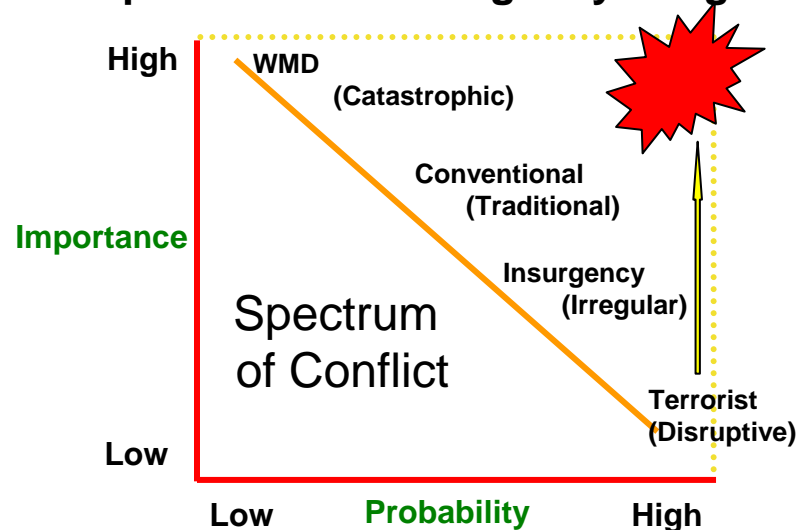


### Bottom Line

Strategic environment for S&T changing rapidly:

- Globalization levels playing field
- USG no longer the major driver
- Reduced cost of access
- Empowered non-traditional actors
- Reduced reaction times

Most probable becoming very dangerous





# ***How Tough Is It?***

## **Rising Above the Gathering Storm**



Norman R Augustine 2005 testimony before Committee on Science  
US House of Representatives

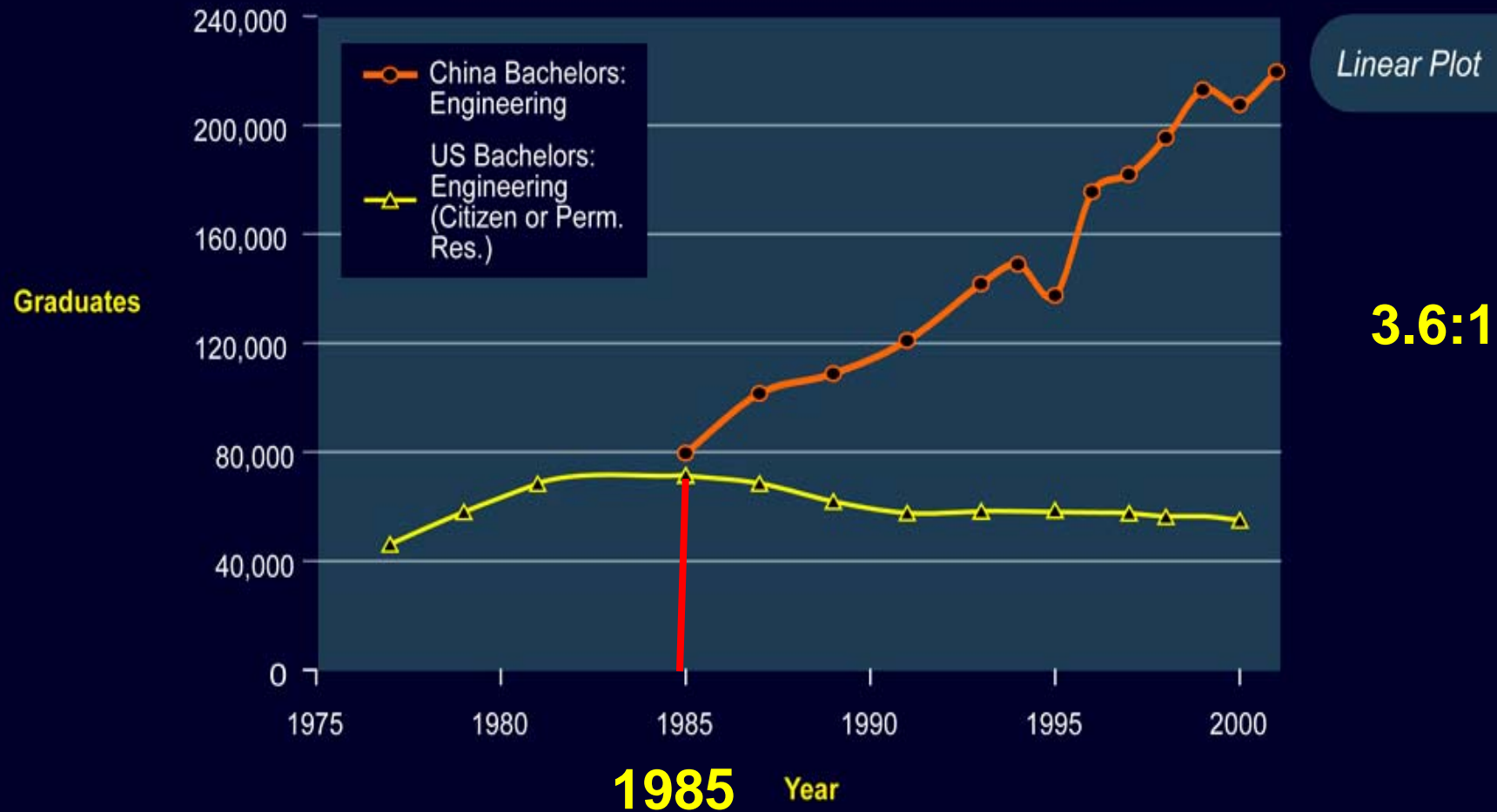
- For the cost of one engineer in the US, a company can hire 11 in India
- In 1997, China had fewer than 50 research centers managed by multinational corporations, by 2004 there were over 600
- About two-thirds of students studying chemistry & physics in US high schools are taught by teachers with no major or certificate in the subject
  - *44% of eighth-graders in Singapore scored at the most advanced level in math, as did 38% in Taiwan – U.S. only 7%*
- In 2003, foreign students earned 59% of the engineering doctorates awarded in the US

*In China today, Bill Gates is Britney Spears. In America today, Britney Spears is Britney Spears – and that is our problem*



# How Tough Is It?

Bachelors Degrees in Engineering,  
US (citizens and permanent residents) and China

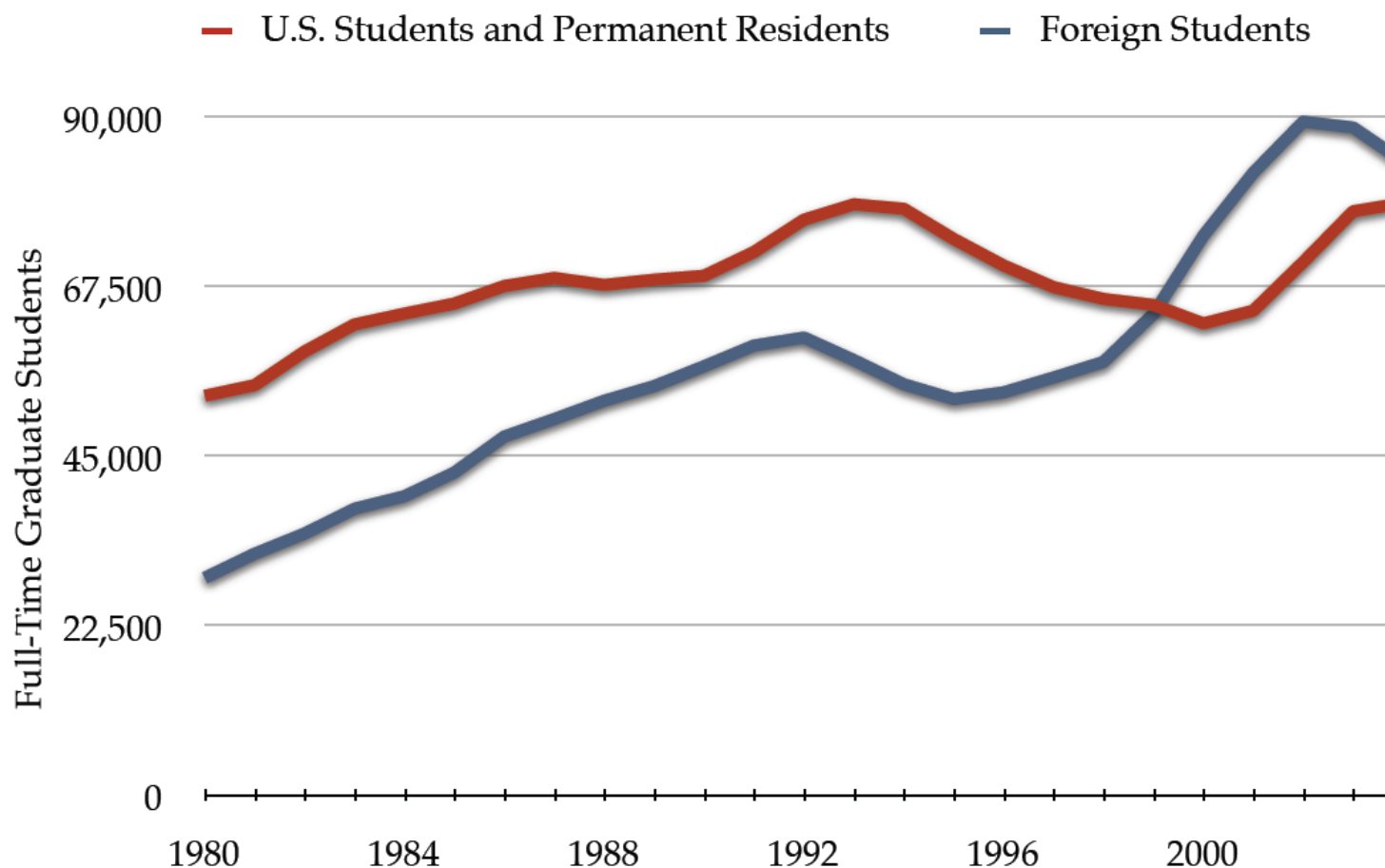


Source: Ray Kurzweil, KurzweilAI.net



# How Tough Is It?

U.S. Graduate Institutions: Foreign Students Outnumber U.S. Students in Physical Science\* and Engineering



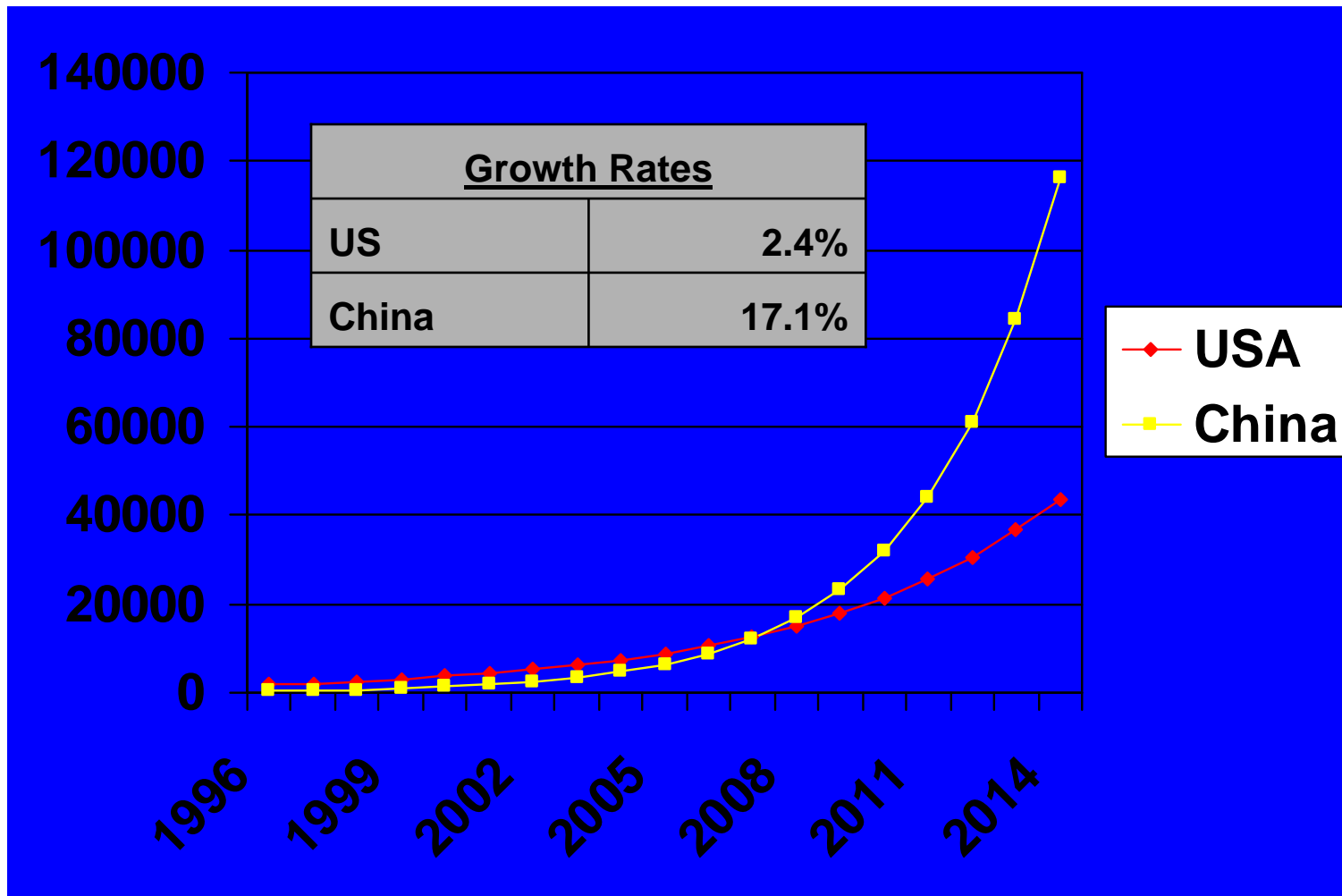
\* Mathematical and Computer Science included.

Source: National Science Foundation Division of Science Resources Statistics: Graduate Students and Postdoctorates in Science and Engineering, Fall 2002, Fall 2003, and Fall 2004. Compiled by the APS Physics Washington Office.





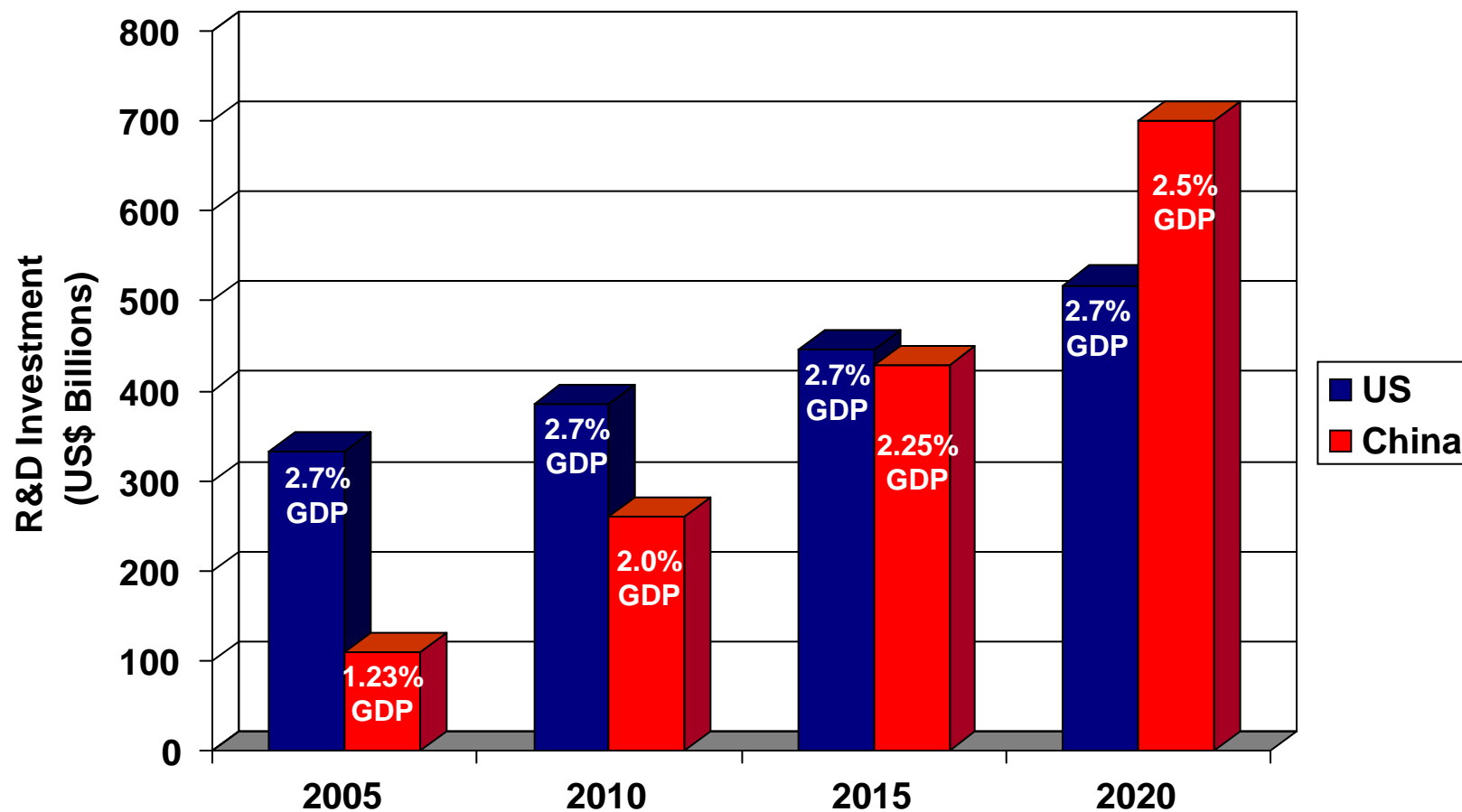
# S&T Publication Trends



**Losing the lead – not an option**



## *R&D Investment at PPP Rates*

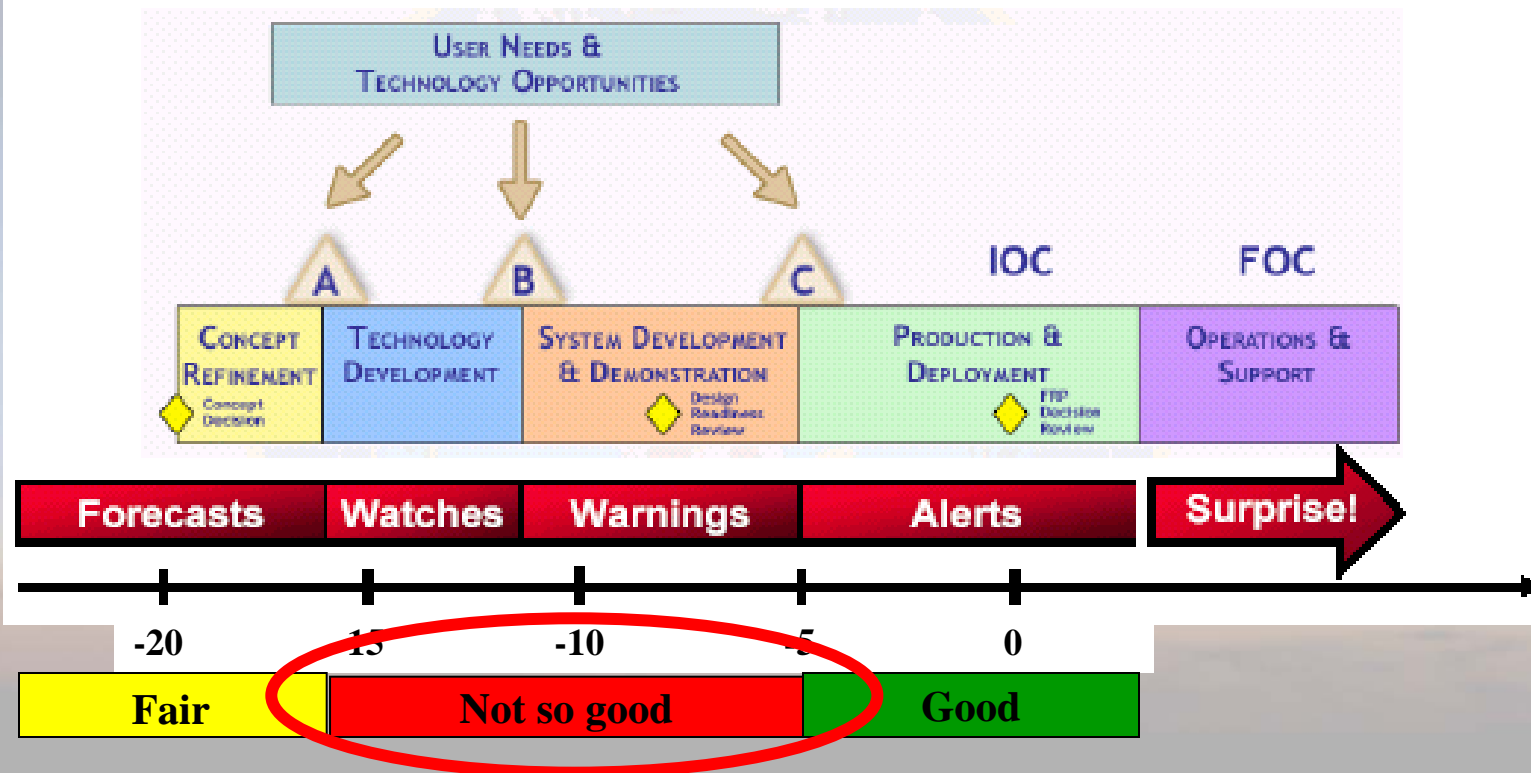




# How Are We Doing?

## Technology Warning Assessments

### Tech Warning & the Traditional Systems Acq Cycle



**Technological Surprise is inevitable!**



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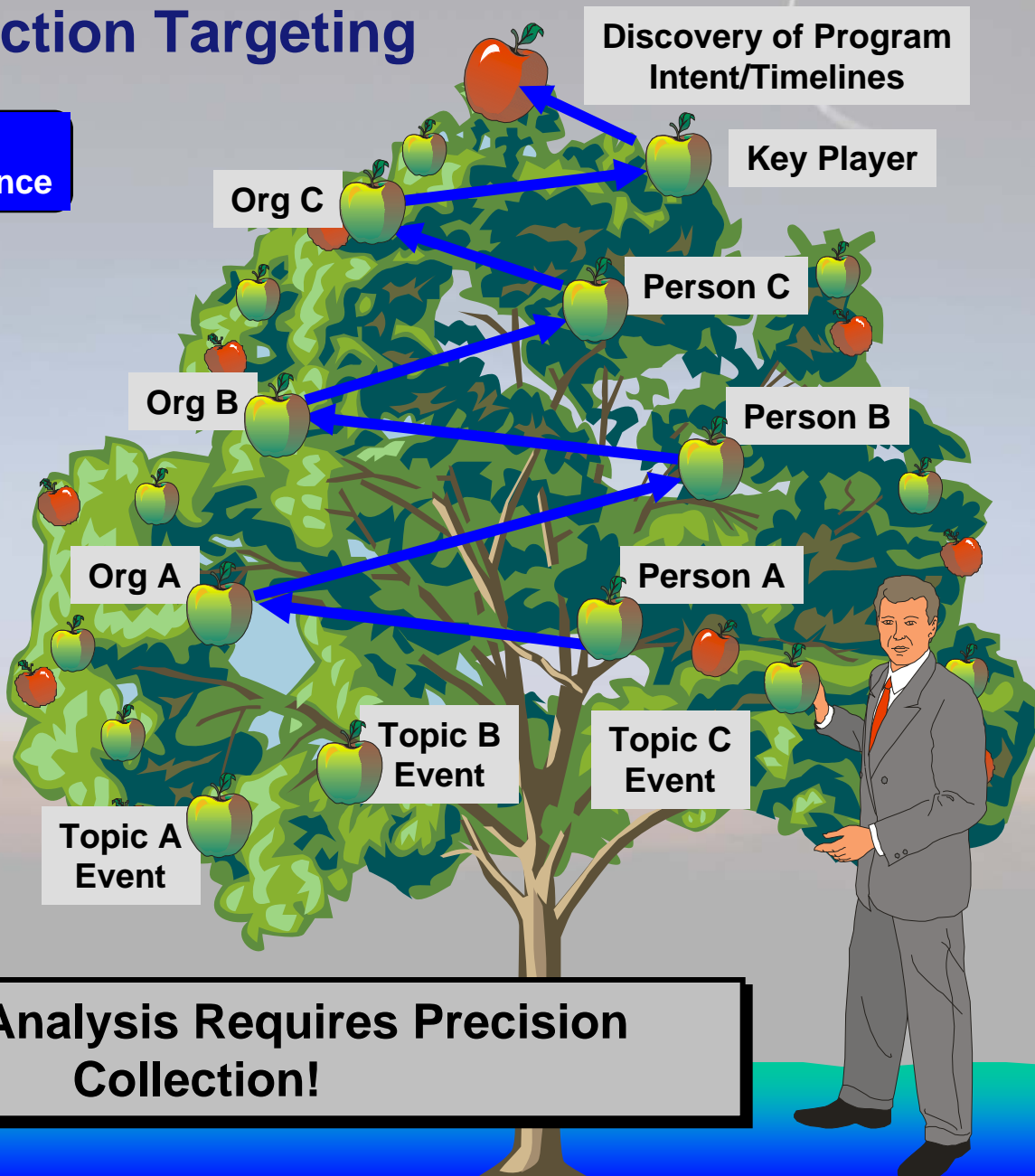
# How Are We Doing?

## Collection Targeting

Field of Vision/  
Predictive Intelligence

High

Low



Discovery of Program  
Intent/Timelines

Key Player

Person C

Org B

Person B

Org A

Person A

Topic B  
Event

Topic C  
Event

Topic A  
Event

Collection  
Priorities

Operations  
GWOT  
WMD

Complex Analysis Requires Precision  
Collection!

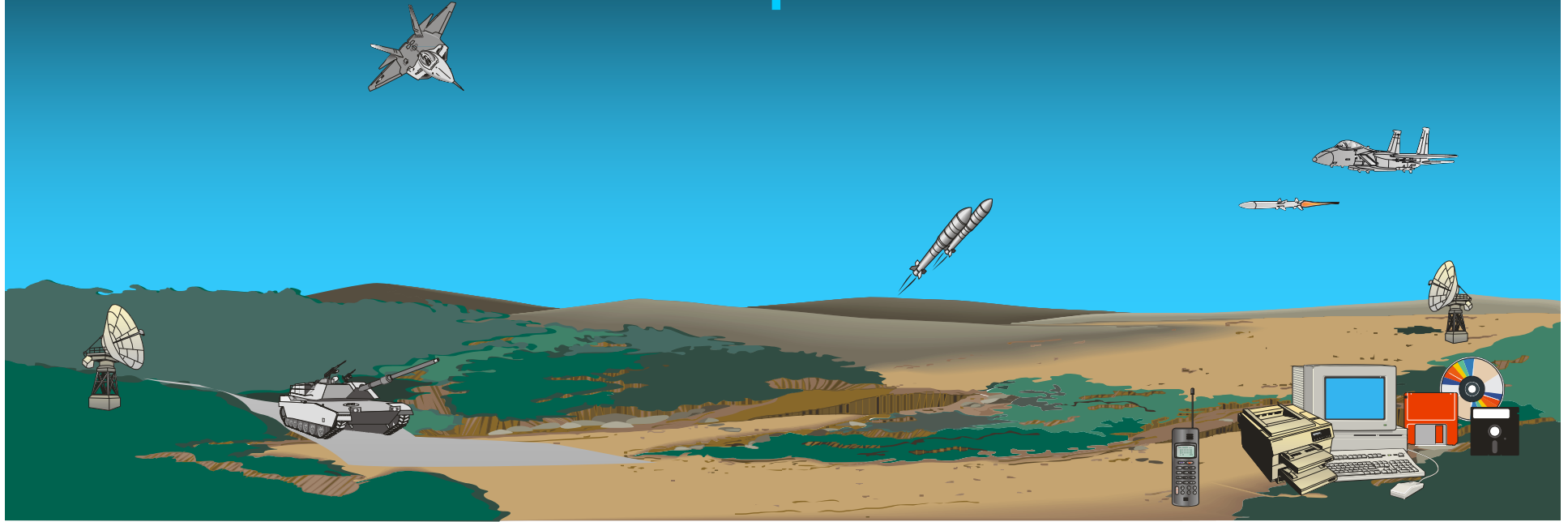
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# How Are We Doing?

## Client Requirements



### Foundational RDA analysis elements



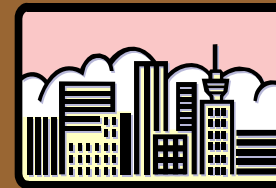
Manpower



Equipment



Materials



Facilities



Processes

**Tendency to lose focus on foundational elements!**

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# ***What Do You Say?***

## **OSD/DDR&E Recommendations**



- 1. Less conservative, more speculative analysis of foreign research and development programs**
- 2. Balance between near term (GWOT) needs and far term forecasting**
  - 1. Enables DoD acquisition programs to be responsive**
- 3. Expand/strengthen technical analysis capability within U.S. intelligence community**
- 4. Establish consistent, community-wide standards of “technology warning”**



# ***What Are We Doing?***

## **Initiating Change**



- **Encourage alternative analysis**
- **Adopted NASA TRLs in assessments**
- **Employed warning terminology in titles of products**
  - **Alert: Technology IOC**
  - **Warning: Technology IOC within 5 yrs**
  - **Watch: Technology IOC within 10 yrs**
  - **Forecast: Technology IOC beyond 10 yrs**
- **Implemented DNI Analytic Standards for reporting**
  - **Sourcing, Confidence Levels, Alternative Analysis**
- **Stood-up AF S&TI collection program**
- **Standardized Intellipedia**



# Technology Insertion Into Programs



**Focus on Gov't/Military Funding**



# ***So You Think You Have It Tough?***



- **One deep in doing technology maturity analysis**
  - Several technologies not followed
  - Training not developed
- **Often key intelligence data is lacking**
  - Trend data difficult to assess
- **Peers & Customers require convincing**
  - To establish “INTENT” you are at TRL 7 and warning time is shortened
- **Classification hurdles persist**
  - Connecting databases is problematic
- **Retention**
  - Analysts and their Knowledge





## *Summary*

- **NASIC supports a broad analytic mission**
  - **Worldwide mission**
    - **Mission shortfalls - several**
- **Globalization/COTS calls for new approach**
- **Need to expand beyond technology control**
  - **Who's watching the COTS store?**
  - **Who's tracking component technology?**
  - **Who's tracking commercial industry takeovers?**
  - **Who's tracking venture capital?**

**Our best hope remains our determination & talent**

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Prevent Technological Surprise



Enable Global Engagement

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